

Preliminary Design of Electrostatic Sensors for MITICA Beam Line Components

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In MITICA, the full-scale prototype of ITER Neutral Beam Injector (NBI), deuterium negative ions will be extracted from the ion source, accelerated and neutralized; the emerging beam, after removal of residual ions, will be finally dumped onto a calorimeter. Monitoring the formation of plasma and its parameters is crucial, for different reasons, in each component of the beam-line. To this aim, various types of electrostatic probes are planned to be installed along the MITICA beam-line.

In particular, the Neutralizer and the Electric Residual Ion Dump (ERID) will be equipped with two sets of double probes. In the case of the neutralizer, where plasma is generated by the collisions between the beam ions and the neutral gas particles, the probes will allow to gain information about the beam collisional processes in view of a neutral fraction optimization. In the ERID component, a transverse electric field is applied to remove ions emerging from the neutralizer: the objective of the probes is to verify that plasma is not formed, which otherwise might shield the electric field and invalidate the deflection properties of the device. In both components, pairs of probes will be placed on the panels at different vertical and axial positions, and configured as Langmuir probes, so to provide local ion density and electron temperature measurements.

Moreover, biased electrodes are being considered for MITICA calorimeter to collect secondary emission electrons produced by collisions with the calorimeter surfaces. While calorimetric measurements provide a vertical profile of the neutral beam at the calorimeter, the electrodes, together with a neutron imaging diagnostic, will provide a horizontal profile of the beam, to study horizontal steering, divergence and uniformity of the beam.

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